PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-008845

(43)Date of publication of application : 12.01.1999

---

(51)Int.Cl. H04N 7/18

H04N 5/222

H04N 5/225

H04N 5/232

---

(21)Application number : 09-261829 (71)Applicant : SONY CORP

(22)Date of filing : 26.09.1997 (72)Inventor : KOYANAGI MASAKAZU

TOMITAKA TADAFUSA

IIJIMA TOSHIYUKI

HOSONUMA NAOYASU

TAMAYAMA KEN

---

(30)Priority

Priority number : 09103456

Priority date : 21.04.1997

Priority country : JP

---

(54) PANORAMIC IMAGE GENERATION DEVICE AND ITS METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To generate a panoramic image that has high picture quality and has no distortion caused at each connection part of the image by mapping plural images which are photographed by controlling the

photographing direction of an image pickup means via a drive means onto a virtual spherical surface that is viewed from the rotational center of the drive means.

SOLUTION: A computer 1 photographs a scenery 4 by controlling a pan tilter camera 3 located at a remote place and displays the image of a photographed screen 5 in an operation area 6A of a monitor 2. When a panoramic screen production instruction is produced via a panorama production button 6E, a pan tilter and a zoom lens are driven to each prescribed position to acquire each image. These acquired images are connected together to a virtual spherical surface defining a mobile axis of the pan tilter as an original point, and a plane image which is normalized in both latitude and longitude directions of the virtual spherical surface is shown in a panoramic image display area 6B. In such a way, a panoramic image is easily produced with no use of an expensive super-wide-angle lens nor fisheye lens.

LEGAL STATUS [Date of request for examination] 17.11.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3744147

[Date of registration] 02.12.2005

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] Panorama image generation equipment characterized by to consist of

an image connection means is distorted by mapping to the virtual spherical surface seen from the bottom of its heart during the revolution of the above-mentioned driving means, and connect two or more images obtained by image pick-up means photo an image, the driving means which controls the bearing which the above-mentioned image pick-up means picturizes, and the above-mentioned image pick-up means that there is nothing.

[Claim 2] Panorama image generation equipment characterized by mapping further the above-mentioned image mapped to the above-mentioned virtual spherical surface at a flat surface by normalizing at the LAT of the above-mentioned virtual spherical surface, and LONG with the above-mentioned image connection means in claim 1.

[Claim 3] It is panorama image generation equipment characterized by having the device in which the above-mentioned driving means has play in a drive system in claim 1, and amending the effect of backlash using the image acquired by driving the above-mentioned driving means in the same direction when connecting the image obtained from the above-mentioned image pick-up means.

[Claim 4] Panorama image generation equipment characterized by connecting an image whenever it acquires the image of one sheet, displaying the result on a display means, and displaying the progress situation of image connection in claim 1 when connecting the image of two or more sheets with the

above-mentioned image connection means.

[Claim 5] Panorama image generation equipment characterized by making it display on the above-mentioned display means after not displaying the connection result on a display means whenever it acquires the image of one sheet in claim 1, when connecting the image of two or more sheets with the above-mentioned image connection means, but acquiring all images.

[Claim 6] Panorama image generation equipment characterized by displaying the result on a display means when the image of two or more sheets is connected with the above-mentioned image connection means, the result is not displayed on a display means, but all images are captured and connection is completed in claim 1 although an image is serially connected whenever it acquires the image of one sheet.

[Claim 7] Panorama image generation equipment characterized by picturizing the image of the movable range of the above-mentioned driving means with the above-mentioned image pick-up means, and generating a panorama image automatically in claim 1.

[Claim 8] Panorama image generation equipment characterized by displaying the above-mentioned panorama image on the actuation field for showing the driving direction of the above-mentioned driving means further in claim 7.

[Claim 9] Panorama image generation equipment characterized by moving the

photographic subject of the location corresponding to one point of the specified arbitration to the position coordinate of the arbitration of the above-mentioned driving means by specifying one point of the arbitration of the above-mentioned actuation field in claim 8.

[Claim 10] Panorama image generation equipment characterized by moving the photographic subject of the location corresponding to one point of the arbitration generated from the field of the above-mentioned arbitration to the position coordinate of the arbitration of the above-mentioned driving means by specifying the field of the arbitration of the above-mentioned actuation field in claim 8.

[Claim 11] The panorama image generation method characterized by consisting of a step which is distorted by mapping to the virtual spherical surface seen from the bottom of its heart during the revolution of the above-mentioned location which carries out photography, and connects the step which photos an image, the step which controls the bearing which picturizes the above-mentioned image, and two or more images obtained by taking a photograph that there is nothing.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention -- high resolution and the panorama image of high quality -- cheap equipment -- and it is related with the panorama image generation equipment and the approach of acquiring easily.

[0002]

[Description of the Prior Art] When images were connected conventionally, the location (pixel) which an image to connect correlates was found out and the technique of piling up, after piling up simply, expanding / reducing the image connected to the image of one sheet or deforming was taken.

[0003]

[Problem(s) to be Solved by the Invention] However, amplification/cutback of an image, and deformation had the problem which brings about deterioration of image quality, such as degradation of the resolution of an image. Moreover, when two or more images were only connected, there was a problem which distortion generates. For example, when connecting the images of ten sheets as shown in drawing 21 A, the image of ten sheets obtained from image pick-up equipment maps the plane group vertical to the optical axis of a lens. For this reason, when having projected between the images which the photographic subject which exists in the depth direction connects according to the technique of only connecting the image of ten sheets, as shown in drawing 21 B, the

problem which distortion produces was in the joining segment.

[0004] Therefore, the object of this invention is high definition and is to offer the panorama image generation equipment and the approach of generating the panorama image which distortion does not produce in a joining segment.

[0005]

[Means for Solving the Problem] Invention according to claim 1 is panorama image generation equipment characterized by to consist of an image connection means is distorted by mapping to the virtual spherical surface seen from the bottom of its heart during the revolution of a driving means, and connect two or more images obtained by image pick-up means to photo an image, the driving means which controls the bearing which an image pick-up means picturizes, and the image pick-up means that there is nothing.

[0006] Invention according to claim 11 is a panorama image generation method characterized by consisting of a step which is distorted by mapping to the virtual spherical surface seen from the bottom of its heart during the revolution of the location to photo, and connects the step which photos an image, the step which controls the bearing which picturizes an image, and two or more images obtained by taking a photograph that there is nothing.

[0007] With an image pick-up means (for example, video camera), while changing into an electrical signal the image of the photographic subject

picturized through the zoom lens and outputting as a video signal, a lens is driven to the zoom lens position coordinate ordered from an image connection means. Moreover, the position coordinate of a current zoom lens is supplied to an image connection means.

[0008] A driving means (for example, punch Ruta) supplies the position coordinate of a current driving means to an image connection means while it can change the direction which drives an image pick-up means to a hand of cut, and image pick-up equipment picturizes and moves a driving means to the position coordinate ordered from an image connection means. An image connection means acquires the pan of current punch Ruta, and the location data of the direction of a tilt from a driving means, and calculates the include-angle coordinate of punch Ruta which makes a home position (for example, center position of the movable range of a driving means) the zero of the LAT and LONG while it acquires the zoom location of a current lens from an image pick-up means and calculates the scale factor. And a driving means is received when directions of panorama image creation occur from the interior of equipment (for example, periodic creation command), or the equipment exterior (for example, an operator's command). In order to acquire the image for creating a panorama image, a position coordinate is directed, an image is acquired after target-position attainment, compression of the image to the map to the virtual

spherical surface of the acquired image, a horizontal, and a perpendicular direction, connection processing to the image captured previously, etc. are performed, and the connected image is outputted to a display means. And the image is connected one by one in such a procedure, and an image is saved while outputting the panorama image obtained eventually to a display means. In addition, in case the target position to a driving means is set up, an image connection means gives directions to a driving means so that the absolute location of a driving means may not be out of order under the effect by backlash, and it may advance into a target position from it being the same.

[0009]

[Embodiment of the Invention] Hereafter, some operation gestalten of this invention are explained with reference to a drawing. Drawing 11 shows the rough configuration of 1 operation gestalt of this invention. The computer 1 to which the monitor 2 and the mouse 8 are connected controls actuation of the punch Ruta camera 3 connected to the remote place. That is, the controller of image pick-up equipment is constituted by the computer 1.

[0010] The punch Ruta camera 3 means what the punch Ruta section and the camera section consisted of in one. In this drawing 1 , the punch Ruta camera 3 is installed in the actual scene in an environment as shown in 4 as an example. The screen (a photography screen is called hereafter) photoed with the punch

Ruta camera 3 installed in the actual scene 4 of this environment is shown in 5. This photography screen is a screen currently photoed actually, if a zoom lens is operated to a looking-far side, a field angle will become small, and a field angle will become large if it is operated to a wide side.

[0011] The image data which were supplied to the computer 1 and supplied to the computer 1 are decoded through a video cable etc., and the image of the photography screen 5 incorporated with the punch Ruta camera 3 is displayed on actuation field 6A of a monitor 2. In the monitor 2, it has panorama image display field 6B. Moreover, by panorama generation carbon button 6E If panorama screen generation directions are made, while driving punch Ruta and a zoom lens to a position and acquiring an image in each location An image is connected to the virtual spherical surface which made the movable shaft of a punch Ruta camera the zero for the acquired image of two or more sheets, and the flat-surface image which normalized to the LAT of the virtual spherical surface and the direction of LONG is displayed. Panorama actuation field 6B is made as [operate / the punch Ruta camera 3] by directing one point of the arbitration in the image or panorama image with which the cursor 7 of an arrow-head form is drawn by the mouse 8 in the location, or field 6C of arbitration with a mouse 8. Furthermore, as a dotted line shows, punch Ruta limiter display 6D is displayed on panorama actuation field 6B. Punch Ruta liter

display 6D shows the limitation of the movable range of the punch Ruta camera 3.

[0012] As shown in drawing 2 , on the screen of a monitor 2, actuation field 6A and panorama actuation field 6B are displayed. By operating a mouse 8, cursor can move and one point of the arbitration of panorama actuation field 6B or one point of the arbitration generated from field 6C of arbitration can be directed. Punch Ruta is made to drive and the image pick-up screen 5 moves so that one point of the directed arbitration may become in the center of actuation field 6A. That is, the result which you want to display beforehand is inputted and the photographic subject chosen according to the input is displayed to become in the center of actuation field 6A.

[0013] Drawing 3 is the block diagram of all the systems that applied one gestalt of implementation of this invention. This system consists of the camera section 11, the punch Ruta section 12, the TV monitor 13, a computer 1, a pointing device 14 of mouse 8 grade, and a monitor 2. Moreover, the punch Ruta camera 3 mentioned above consists of the camera section 11 and the punch Ruta section 12, and the camera section 11 is installed on the punch Ruta section 12 as an example. The camera section 11 consists of the lens block section 15, a zoom lens 16, the zoom section 17, the motor 18 for zoom lens 16, a solid state image pickup device 19, signal separation / automatic-gain-control circuit 20

(SH/AGC), A/D converter 21, and a digital disposal circuit 22, and shows a video camera as a whole.

[0014] The punch Ruta section 12 consists of the mode controller 23, the camera controller 24, the punch Ruta controller 25, a motor 26 for pans, a motor 27 for tilts, and punch Ruta 28. A computer 1 consists of a control section 31, the video capture section 29 which consists of a video capture board, and the storage section 30.

[0015] Image formation of the image pick-up light which reaches from a photographic subject is carried out to a solid state image pickup device 19 through the lens group of the lens block section 15, and drawing. There is CCD (Charge Coupled Device) as an example of a solid state image pickup device 19. After the image pick-up light by which image formation was carried out changes a visual field image into a video signal, it is supplied to signal separation / automatic-gain-control circuit 20. In signal separation / automatic-gain-control circuit 20, while sample hold of the image output signal is carried out, gain control is carried out so that it may have predetermined gain with the control signal of an auto iris (AE). The image output signal acquired is supplied to a digital disposal circuit 22 through A/D converter 21 by it. In a digital disposal circuit 22, the inputted signal is changed into each signals, such as brightness (Y), a color (C), and a video signal, and is supplied to the video capture section

29 of a computer 1 through the TV monitor 13 as a video signal.

[0016] Moreover, it is made possible to change the field angle picturized by driving a zoom lens 16 of the lens block section 15 of the camera section 11. This lens block section 15 rotates the motor 18 which consists of a stepping motor, and makes a zoom lens 16 drive with the actuation instruction of the camera controller 24 of the punch Ruta section 12. This camera controller 24 is also performing the interface with the mode controller 23 while being a controller which usually performs lens control (for example, a focus, a zoom, etc.) of the camera section 11, exposure control (for example, extracting gain, electronic shutter speed, etc.), white balance control, image quality control, etc. While outputting a control signal to Motor Driver as interface control relevant to control of a zoom lens 16 to the actuation instruction of the zoom lens 16 sent from the mode controller 23 so that it may drive in the location where the zoom lens 16 was ordered, the positional information of the current zoom lens 16 always communicates for the mode controller 23.

[0017] Moreover, the camera section 11 is installed on the punch Ruta section 12 which are a pan and equipment with the degree of freedom of a biaxial hand of cut called a tilt. With the actuation instruction of the punch Ruta controller 25, the punch Ruta section 12 rotates the motor 26 for pans, and the motor 27 for tilts, and the universal head of punch Ruta 28 drives it respectively. There is a

stepping motor as an example of these motors 26 and 27. while, as for this punch Ruta controller 25, a pan and the universal head of each tilt output a control signal to Motor Driver to the pan and the actuation instruction of the direction of each tilt which are sent from the mode controller 23 so that it may drive in the ordered location, the positional information of the pan of current punch Ruta 28 and the universal head of each tilt always communicates for the mode controller 23.

[0018] The mode controller 23 controls the whole system according to the interface information from the internal state of the camera section 11 and the punch Ruta section 12, and the outside of the punch Ruta camera 3 to mention later. The mode controller 23 is connected with a computer 1 by RS-232C, and while distributing an instruction to the punch Ruta controller 25 and the camera controller 24 to the actuation instruction from a computer 1 so that the zoom lens 16 of punch Ruta 28 and the lens block section 15 may be driven, the current positional information sent from the punch Ruta controller 25 and the camera controller 24 is transmitted to a computer 1.

[0019] With one gestalt of this operation, in order to choose the image which the punch Ruta camera 3 projects, the computer 1 is used. And the commo data to the mode controller 23 is determined by processing the information acquired from the graphical display displayed on actuation field 6A on the screen of a

monitor 2, and panorama actuation field 6B, and actuation of the directions location of a pointing device 14 (mouse 8), a click, etc. Moreover, in order to display the image of the camera section 11 on a monitor 2, the video capture section 29 is used. This video capture section 29 can be captured in the quality of arbitration with a capture signal to the graphics formats (for example, the still picture of a bit map format and a JPEG format, the animation of a JPEG format, etc.) of arbitration, and can carry out storage on the storage section 30 (for example, hard disk) of a computer 1 while it can display the video signal inputted from the camera section 11 on a monitor 2 in the quality of arbitration.

[0020] Here, rough explanation for creating the panorama image in one gestalt of this operation is given using drawing 4 . First, let the surrounding environment where the punch Ruta camera 3 is set up be the spherical surface. This is called the virtual spherical surface. In this drawing 4 , the image of two ****** on the virtual spherical surface is connected, and the panorama image of one sheet is created. First, in order to create a panorama image, as shown in drawing 4 A, the punch Ruta camera 3 located at the core photos the image of two ****** on the virtual spherical surface. The punch Ruta camera 3 picturizes the flat surface which intersects perpendicularly with the optical axis of a lens. Drawing 4 D shows the condition that these two images were mapped by the flat surface which intersects perpendicularly with an optical axis, by picturizing the image of

two ****** on the virtual spherical surface with the punch Ruta camera 3. When the image of two ****** is connected simply, there are duplication of a knot and a part which distortion produces.

[0021] Duplication of this knot, and in order to lose distortion, as shown in drawing 4 B, the image of two ****** is mapped in the virtual spherical surface, respectively. Drawing 4 E shows the condition of having mapped two image pick-up images which are the flat surfaces which intersect perpendicularly with an optical axis in the virtual spherical surface. Thus, the flat surface which intersects perpendicularly with an optical axis, i.e., an image pick-up image, is mapped to the virtual spherical surface, the mapped image is connected, and connection processing of an image in which deletion of a duplication image and an unnecessary image is performed is performed. And by normalizing the image mapped by the virtual spherical surface at the LAT and LONG, as shown in drawing 4 C and drawing 4 D, a panorama image is generable.

[0022] Next, law is explained while creating the panorama image by this invention. By this one approach, as shown in drawing 5 , the image of ten sheets is connected and it considers as the panorama image of one sheet. First, the image of ten sheets is photoed from the punch Ruta camera 3 (not shown) arranged at the core of the virtual spherical surface as shown in drawing 5 A. At this time, the punch Ruta camera 3 can acquire each image of 1-10 by setting

the optical axis of the lens of the punch Ruta camera 3 by the location shown with a circle for every image field as shown in drawing. The image picturized with the punch Ruta camera 3 is an image on the flat surface which intersects perpendicularly with the optical axis of a lens, as shown in drawing 5 B. After being developed on the virtual spherical surface, respectively, the acquired image is normalized at the LAT and LONG, as shown in drawing 5 C. In the case of connection processing, as for the image of ten sheets developed on the virtual spherical surface, acquisition of an image is performed to a knot in a location where each other image overlaps so that there may be no omission. And after deletion of a duplication image and an unnecessary image is made, the image of ten sheets is connected, and a panorama image is generated as shown in drawing 5 D.

[0023] Next, other approaches of creating the panorama image by this invention are explained with reference to drawing 6 . It is computed which pixel of the image acquired with the punch Ruta camera 3 is assigned, the pixel (s, t), i.e., each coordinate, of the panorama image which it normalizes at the LAT and LONG. When the pixel of the image acquired with the punch Ruta camera 3 is made equivalent to the pixel of a panorama image like the approach of drawing 5 , it is for making the pixel of the image which the pixel of a panorama image without a corresponding pixel may produce, and was acquired to all the pixels of

a panorama image correspond. Thus, a panorama image is realized by the pixel computed for every coordinate. As a procedure of the processing, the include-angle coordinate (alpha, beta) on the virtual spherical surface corresponding to the coordinate (s, t) (drawing 6 A) of a panorama image (drawing 6 B) is first computed using a formula (1).

[0024]

(alpha, beta) = (a (s), b (t)) (1)

The detail of this formula (1) is explained in drawing 7 mentioned later.

[0025] As the wide edge of image pick-up equipment is indicated to be the include-angle coordinate (theta, phi) of punch Ruta 28 which acquired this coordinate (s, t) and image to drawing 6 C using the image pick-up scale factor gamma made into 1 time, the coordinate data on the acquired image (xi, eta) is computed using a formula (2).

[0026]

(xi, eta) = (f (alpha, beta, theta, phi, gamma), g (alpha, beta, theta, phi, gamma)) (2)

The detail of this formula (2) is explained in drawing 8 mentioned later.

[0027] The connection image, i.e., a panorama image, is generated by matching each pixel of a panorama image, and the acquired image using the above formula.

[0028] Here, how to change into the include-angle coordinate on the virtual spherical surface (alpha, beta) the coordinate (s, t) of the panorama image mentioned above is explained using drawing 7 . First, PragMin shown in drawing 7 A is include-angle data of the left end when setting the home position of punch Ruta 28 to 0 (rag), and is PragMax. It is include-angle data of the right end when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Ny2 It is the horizontal coordinate of panorama actuation field 6B, -Ny2 / 2 are coordinate data at the left end of panorama actuation field 6B, and Ny2 / 2 are coordinate data at the right end of panorama actuation field 6B.

[0029] And in order to ask for the paninclude angle alpha from coordinate data s, it is set to (PragMax-alpha):(PragMax-PragMin)=:(Ny2 / 2-s) Ny2, and the paninclude angle alpha is alpha=PragMax from this. - (PragMax-PragMin) It is set to x / (Ny2 / 2-s) Ny2.

[0030] Moreover, TragMin shown in drawing 7 B It is include-angle data of the upper bed when setting the home position of punch Ruta 28 to 0 (rag), and is TragMax. It is include-angle data of the soffit when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Nz2 It is the coordinate of the perpendicular direction of panorama actuation field 6B, -Nz2 / 2 are coordinate data of the upper bed of panorama actuation field 6B, and Nz2 / 2 are coordinate data of the soffit of panorama actuation field 6B.

[0031] And in order to ask for beta whenever [tilt angle] from coordinate data t, it is set to (TragMax-beta):(TragMax-TragMin)=:(Nz2 / 2-t) Nz2, and beta is beta=TragMax whenever [tilt angle] from this. - (TragMax-TragMin) It is set to x / (Nz2 / 2-t) Nz2.

[0032] With reference to drawing 8 , processing of flat-surface spherical-surface conversion is explained. As shown in drawing 8 A, the coordinate on the space of the point (xi, eta) on the camera image which turned to the home position (zero of the LAT and LONG) can be expressed as follows.

[0033]

[Equation 1]

$$P = e_x + k_1 \xi e_\xi + k_2 \eta e_\eta$$

$$= \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + k_1 \xi \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} + k_2 \eta \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ -k_1 \xi \\ k_2 \eta \end{bmatrix}$$

[0034] At this time, it is k1 =tan(lambda/2gamma)/(Ny/2).

k2 =tan(mu/2gamma)/(Nz/2)

A next door, and (Ny, Nz) are the actuation range (the direction of y, the direction of z) of a pointing device 14 (mouse 8), (lambda, mu) are a horizontal in a wide edge, and a vertical field angle, and gamma is a current zoom relative magnification (scale-factor information) which makes a wide edge 1 time.

[0035] Moreover, as shown in drawing 8 B, generally it is known that the revolution matrix of a three dimension is shown like a degree type.

[0036]

[Equation 2]

$$R_y(\phi) = \begin{bmatrix} \cos\phi & 0 & -\sin\phi \\ 0 & 1 & 0 \\ \sin\phi & 0 & \cos\phi \end{bmatrix}$$

$$R_z(\theta) = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

[0037] Since there is only a home position to include-angle information (theta, phi) in the direction where (alpha, beta) have one same point, the following relation consists of 1 on a pan and the camera image which carried out the tilt (xi, eta), and a home position.

[0038]

Rz Ry (theta) p=lRz (phi) Ry (alpha) ex (beta) -- if this is solved about p -- [0039]

[Equation 3]

$$p = l\, R_y(-\phi)\, R_z(\alpha - \theta)\, R_y(\beta)\, e_x$$

$$= l \begin{bmatrix} \cos(\alpha - \theta)\cos\phi\cos\beta + \sin\phi\sin\beta \\ \sin(\alpha - \theta)\cos\beta \\ -\cos(\alpha - \theta)\sin\phi\cos\beta + \cos\phi\sin\beta \end{bmatrix}$$

[0040] It is here and is [0041].

[Equation 4]

$$p = l \begin{bmatrix} a \\ b \\ c \end{bmatrix} \qquad (4)$$

[0042] If it sets, xi and eta will be called for as follows.

[0043] l=1 / axi=-lb/k1 -- it projects on an image pick-up coordinate from the coordinate data which is in the include angle of (alpha, beta) from a home position from the formula more than =-b/k1a eta=lc/k 2 =c/k2a -- having (xi, eta) -- it can ask.

[0044] xi=(-sin(alpha-theta) cosbeta)/() [k1] (cos(alpha-theta) cosphi cosbeta+sinphi sinbeta) eta=(-cos(alpha-theta) sinphi cosbeta+cosphi

sinbeta)/(k2) -- thus, (cos(alpha-theta) cosphi cosbeta+sinphi sinbeta) By asking for the coordinate data (xi, eta) on the image acquired from the include-angle coordinate (alpha, beta) on the virtual spherical surface corresponding to the coordinate (s, t) of a panorama image with the punch Ruta camera 3, a panorama image is generable.

[0045] conversely, it projects on an image pick-up coordinate from the following formulas -- having (xi, eta) -- it can also ask for the coordinate data in the include angle of (alpha, beta).

[0046] First, since it is l=|p|, it is a=1/root (1+k1 2 xi2+k2 2 eta2).

b=-k1 xi/root (1+k1 2 xi2+k2 2 eta2)

c=k2 eta/root (1+k1 2 xi2+k2 2 eta2)

It becomes. However, root ( ) processes a square root to the count result in ( ).

[0047] Moreover, it is set to a=cos(alpha-theta) cosphi cosbeta+sin phi sinbetab=sin (alpha-theta) cosbetac=-cos(alpha-theta) sinphi cosbeta+cosphi sinbeta from a formula (3).

[0048] It is a sin phi+c sin theta=-1 (sinphi/root(1+k1 2 xi2+k2 2 eta2)+sinthetak2 eta/root (1+k1 2 xi2+k2 2 eta2)) from the above formula. sinbetatan (alpha-theta) Since it is =b/(a cosphi-c sintheta), it is beta=sin.

Alpha=tan It is set to -1(-k1 xi/(cos phi-k 2 eta sintheta))+theta.

[0049] Therefore, = (alpha, beta) (f (xi, eta, theta, phi, gamma), g (xi, eta, theta,

phi, gamma)) (4)

******** -- things are made.

[0050] moreover -- if some errors are permitted -- being as follows (alpha, beta) -- it can ask.

[0051] Alpha=theta + (lambda/gamma) x (xi/Ny)

Beta=phi + (micro/gamma) x (eta/Nz)

That is, formula (4) (alpha, beta) = (f (xi, theta, gamma), g (eta, phi, gamma)) (5)

It can become and simplify.

[0052] The processing which computes the include-angle information (alpha, beta) on punch Ruta 28 shown in the formula (4) and formula (5) which were mentioned above from the position coordinate (xi, eta) of actuation field 6A is explained using drawing 9 . First, an example of an approach which specifies one point of the arbitration in actuation field 6A directly is explained. As shown in drawing 9 A, it considers as the relative coordinate which set the core of actuation field 6A to (0, 0), and the position coordinate (xi, eta) of the mouse 8 on the actuation field 6A is acquired.

[0053] Next, an example of other approaches which specifies one point of the arbitration generated from the field of the arbitration in actuation field 6A is explained. First, it is a main coordinate of the square which the end-of-region point (m2, n2) of arbitration is specified, and is generated from these two points

after the starting point (m1, n1) of the field of arbitration is specified, as shown in drawing 9 A. (xi, eta) = (m1, n1) (+ (m2, n2))/2 (6)

It is alike and one point (xi, eta) of arbitration is acquired more.

[0054] This drawing 9 A is the coordinate of the mouse 8 (pointing device 14) on actuation field 6A, and sets the movable range of the mouse 8 in actuation field 6A (the direction of y, the direction of z) to (Ny1 and Nz1). The include-angle coordinate (alpha, beta) of punch Ruta 28 is searched for from a formula (4) or a formula (5) using the position coordinate (xi, eta) of one point (mouse 8) of this arbitration, the include-angle information (theta, phi) which punch Ruta 28 has turned to, and the scale-factor information (gamma) made into the current zoom relative magnification which makes the wide edge of a zoom lens 16 1 time.

[0055] The include-angle coordinate (alpha, beta) shown in drawing 9 B is for projecting on the core of an image pick-up screen the location specified with the pointing device, when the home position of punch Ruta 28 is made into the zero of the LAT and LONG.

[0056] In this drawing 9 , the absolute coordinate of the screen of a monitor 2 is sufficient as the coordinate searched for, and the relative coordinate which set the core of actuation field 6A to (0, 0) is sufficient as it. This coordinate shows the coordinate of the direction of a pan by xi, m1, m2, theta, and alpha, and shows the coordinate of the direction of a tilt by eta, n1, n2, phi, and beta.

[0057] Thus, the include-angle information on current punch Ruta 28 obtained with received data when a mouse 8 was in actuation field 6A (theta, phi), The photographic subject on specified actuation field 6A computes the include-angle information on punch Ruta 28 (alpha, beta) that it comes to the core of actuation field 6A, using a formula (4) or a formula (5) using the scale-factor information (gamma) on a zoom, and the positional information (xi, eta) of the mouse 8 of the field specified with the mouse 8. In this way, according to drawing 11 , the include-angle coordinate (alpha, beta) of obtained punch Ruta 28 is changed into the internal positional information (PNew, TNew) of punch Ruta 28, and is stored in a transmission buffer with the absolute location actuation instruction of punch Ruta 28. Moreover, it is a data Request-to-Send flag (FlagSo) simultaneously so that it may mention later. It sets and data are transmitted in a timer event.

[0058] The processing which changes into an include-angle coordinate (alpha, beta) the position coordinate (xi, eta) of the mouse 8 of panorama actuation field 6B with which a panorama image is displayed is explained using drawing 10 . The method of specifying one point of the arbitration in panorama actuation field 6B directly can acquire the position coordinate (xi, eta) of a mouse 8, as it is the approach of specifying directly, and the same approach and one point of the arbitration in actuation field 6A mentioned above is shown in drawing 10 A.

[0059] Next, an example of other approaches which specifies one point of the arbitration generated from the field of the arbitration in panorama actuation field 6B is explained. First, as shown in drawing 10 A, after the starting point (m1, n1) of the field of arbitration is specified, the end-of-region point (m2, n2) of arbitration is specified, and one point (xi, eta) of arbitration is acquired by the formula (6).

[0060] This drawing 10 A is the coordinate of the mouse 8 (pointing device 14) on panorama actuation field 6B, and sets the movable range of the mouse 8 in panorama actuation field 6B (the direction of y, the direction of z) to (Ny2 and Nz2). This movable range is restricted in panorama actuation field 6B by punch Ruta limiter display 6D shown by the dotted line. This punch Ruta limiter display 6D shows the movable range of the optical axis of the lens of the punch Ruta camera 3. That is, it cannot direct more than punch Ruta limiter display 6D. The position coordinate of one point of this arbitration (xi, eta), and the include-angle information which punch Ruta 28 has turned to (theta, phi), The include-angle coordinate (alpha, beta) of the position coordinate (x y) of panorama actuation field 6B, field angle information (s, t), and punch Ruta 28 is searched for from a formula (7), a formula (8), and a formula (9) using the scale-factor information (gamma) made into the current zoom relative magnification which makes the wide edge of a zoom lens 16 1 time.

[0061]

(x y) = (f0 (theta) and g0) (phi) (7)

(s, t) = (f1 (gamma) and g1) (gamma) (8)

(alpha, beta) = (f (xi), g (eta)) (9)

The position coordinate (x y) shown in drawing 10 B is the sense of present punch Ruta 28, when the home position of punch Ruta 28 is made into the zero of the LAT and LONG, and field angle information (s, t) is a field angle currently displayed on present actuation field 6A. This drawing 10 B displays a zoom on panorama actuation field 6B, and the condition of punch Ruta.

[0062] The include-angle coordinate (alpha, beta) shown in drawing 10 C is for projecting on the core of an image pick-up screen the location specified with the pointing device, when the home position of punch Ruta 28 is made into the zero of the LAT and LONG. (PragMax, TragMax) - (PragMin, TragMin) is the range of punch Ruta which can be driven, i.e., the range shown by punch Ruta limiter display 6D. This drawing 10 C expresses the actuation desired value on the punch Ruta movable range.

[0063] In this drawing 10 , the absolute coordinate of the screen of a monitor 2 is sufficient as the coordinate searched for, and the relative coordinate which set the core of panorama actuation field 6B to (0, 0) is sufficient as it. This coordinate shows the coordinate of the direction of a pan by xi, m1, m2, x, s, and

alpha, and shows the coordinate of the direction of a tilt by eta, n1, n2, y, t, and beta.

[0064] Thus, when a mouse 8 is in panorama actuation field 6B, the photographic subject on specified actuation field 6A computes the include-angle information on punch Ruta 28 (alpha, beta) that it comes to the core of actuation field 6A, using a formula (9) using the positional information (xi, eta) of the mouse 8 of the field specified with the mouse 8. In this way, according to drawing 11 , the include-angle coordinate (alpha, beta) of obtained punch Ruta 28 is changed into the internal positional information (PNew, TNew) of punch Ruta 28, and is stored in a transmission buffer with the absolute location actuation instruction of punch Ruta 28. Moreover, a data Request-to-Send flag (FlagSo) is set simultaneously, and data are transmitted in a timer event so that it may mention later.

[0065] Here, how to change an include-angle coordinate (alpha, beta) into the positional information (PNew and TNew) of the punch Ruta 28 interior is explained to the approach list which changes into include-angle information (theta, phi) the positional information (p, t) of the punch Ruta 28 interior mentioned above using drawing 11 . First, PragMin shown in drawing 11 A It is include-angle data of the left end when setting the home position of punch Ruta 28 to 0 (rag), and is PragMax. It is include-angle data of the right end when

setting the home position of punch Ruta 28 to 0 (rag). Moreover, PdatMin It is internal count data at the left end of the punch Ruta controller 25, and is PdatMax. It is internal count data at the right end of the punch Ruta controller 25.

[0066] And in order to ask for the paninclude angle theta from the pandata p, it becomes

(PragMax-theta):(PragMax-PragMin)=(PdatMax-p):(PdatMax-PdatMin), and the paninclude angle theta is theta=PragMax from this. It becomes -(PragMax-PragMin)x(PdatMax-p)/(PdatMax-PdatMin).

[0067] Moreover, the pandata p serve as p=PdatMax-(PragMax-theta) x(PdatMax-PdatMin)/(PragMax-PragMin) from this.

[0068] Moreover, in order to ask for the pandata PNew from the paninclude angle alpha, it becomes

(PragMax-alpha):(PragMax-PragMin)=(PdatMax-p-new):(PdatMax-PdatMin)

and the pandata PNew serve as PNew=PragMax-(PragMax-alpha) x(PdatMax-PdatMin)/(PragMax-PragMin) from this.

[0069] Moreover, TragMin shown in drawing 11 B It is include-angle data of the upper bed when setting the home position of punch Ruta 28 to 0 (rag), and is TragMax. It is include-angle data of the soffit when setting the home position of punch Ruta 28 to 0 (rag). Moreover, TdatMin It is internal count data of the upper bed of the punch Ruta controller 25, and is TdatMax. It is internal count data of

the soffit of the punch Ruta controller 25.

[0070] And in order to ask for phi whenever [tilt angle] from the tilt data t, it becomes (TragMax-phi):(TragMax-TragMin)=(TdatMax-t):(TdatMax-TdatMin), and phi is phi=TragMax whenever [tilt angle] from this. It becomes -(TragMax-TragMin)x(TdatMax-t)/(TdatMax-TdatMin).

[0071] Moreover, the tilt data t serve as t=TdatMax-(TragMax-phi) x(TdatMax-TdatMin)/(TragMax-TragMin) from this.

[0072] Moreover, it is (TragMax-beta):(TragMax-TragMin)=(TdatMax-TNew) in order to ask for the tilt data TNew from whenever [tilt angle / beta]. : (TdatMax-TdatMin) Becoming, the tilt data TNew are TNew=TragMax-(TragMax-beta) x(TdatMax-TdatMin)/(TragMax-TragMin) from this.

It becomes.

[0073] Next, how to change the include-angle information on punch Ruta 28 (theta, phi) into the position coordinate in panorama actuation field 6B (x y) is explained to the approach list which changes into the include-angle coordinate (alpha, beta) of punch Ruta 28 the position coordinate in panorama actuation field 6B mentioned above (xi, eta) using drawing 12 . First, PragMin shown in drawing 12 A It is include-angle data of the left end when setting the home position of punch Ruta 28 to 0 (rag), and is PragMax. It is include-angle data of

the right end when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Ny2 It is the horizontal coordinate of panorama actuation field 6B, -Ny2 / 2 are coordinate data at the left end of panorama actuation field 6B, and Ny2 / 2 are coordinate data at the right end of panorama actuation field 6B.

[0074] And in order to ask for the paninclude angle alpha from coordinate data xi, it is set to (PragMax-alpha):(PragMax-PragMin)=:(Ny2 / 2-xi) Ny2, and the paninclude angle alpha is alpha=PragMax from this. - (PragMax-PragMin) It is set to x / (Ny2 / 2-xi) Ny2.

[0075] Moreover, in order to ask for coordinate data x from the paninclude angle theta, it is set to (PragMax-theta):(PragMax-PragMin)=:(Ny2 / 2-x) Ny2, and coordinate data x becomes x=Ny2 / 2-(PragMax-theta) xNy2/(PragMax-PragMin) from this.

[0076] Moreover, TragMin shown in drawing 12 B It is include-angle data of the upper bed when setting the home position of punch Ruta 28 to 0 (rag), and is TragMax. It is include-angle data of the soffit when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Nz2 It is the coordinate of the perpendicular direction of panorama actuation field 6B, -Nz2 / 2 are coordinate data of the upper bed of panorama actuation field 6B, and Nz2 / 2 are coordinate data of the soffit of panorama actuation field 6B.

[0077] And in order to ask for beta whenever [tilt angle] from coordinate data

eta, it is set to (TragMax-beta):(TragMax-TragMin)=:(Nz2 / 2-eta) Nz2, and beta is beta=TragMax whenever [tilt angle] from this. - (TragMax-TragMin) It is set to x / (Nz2 / 2-eta) Nz2.

[0078] Moreover, in order to ask for coordinate data y from whenever [tilt angle / phi], it is set to (TragMax-phi):(TragMax-TragMin)=:(Nz2 / 2-y) Nz2, and coordinate data y becomes y=Nz2 / 2-(TragMax-theta) xNz2/(TragMax-TragMin) from this.

[0079] How to change into the field angle information on picture frame 6C in panorama actuation field 6B (s, t) from the field angle information (psi, omega) which punch Ruta 28 is starting is explained using drawing 13 . First, the field angle information on present punch Ruta 28 (psi, omega) is shown in drawing 13 A. This field angle information (psi, omega) is =(psi, omega) 1/gammax (psi0, omega0).

It asks "Be alike." At this time, (psi0, omega0) show the horizontal angles of view and the vertical field angle in a wide edge, and gamma shows the lens scale factor when making a wide edge into 1 time.

[0080] It is PragMin as shown in drawing 13 B. It is include-angle data of the left end when setting the home position of punch Ruta 28 to 0 (rag), and is PragMax. It is include-angle data of the right end when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Ny2 It is the horizontal coordinate of panorama

actuation field 6B, -Ny2 / 2 are coordinate data at the left end of panorama actuation field 6B, and Ny2 / 2 are coordinate data at the right end of panorama actuation field 6B.

[0081] And in order to search for horizontal angles of view s from horizontal angles of view psi, it becomes psi:(PragMax-PragMin) =s:Ny2 and horizontal angles of view s become s=psixNy 2/(PragMax-PragMin) from this.

[0082] Moreover, TragMin shown in drawing 13 C It is include-angle data of the soffit when setting the home position of punch Ruta 28 to 0 (rag), and is TragMax. It is include-angle data of the upper bed when setting the home position of punch Ruta 28 to 0 (rag). Moreover, Nz2 It is the coordinate of the perpendicular direction of panorama actuation field 6B, -Nz2 / 2 are coordinate data of the soffit of panorama actuation field 6B, and Nz2 / 2 are coordinate data of the upper bed of panorama actuation field 6B.

[0083] And in order to ask for the vertical field angle t from the vertical field angle omega, it becomes omega:(TragMax-TragMin) =t:Nz2 and the vertical field angle t becomes t=omegaxNz 2/(TragMax-TragMin) from this.

[0084] From these, the field angle information (s, t) shown in drawing 13 D is displayed as picture frame 6C in panorama actuation field 6B.

[0085] Next, how to change into scale-factor information (gamma) the positional information (z) of the zoom lens 16 mentioned above is explained using drawing

14 . This drawing 14 expresses lens scale-factor information to an axis of ordinate, and expresses the internal information of a zoom lens with an axis of abscissa. Positional information (z) of the acquired zoom lens 16 is compared and made into the conversion graph shown in drawing 14 , and is changed into scale-factor information (gamma) on a computer 1. Positional information (z) is changed into scale-factor information (gamma) by a ROM table or the formula as an example.

[0086] Next, an example of the control algorithm in a computer 1 is explained using drawing 15 . First, at step S1, a start of a program performs initialization to which actuation field 6A, panorama actuation field 6B, cursor 7, and the punch Ruta limiter further shown in punch Ruta limiter display 6D are set on a monitor 2, as shown in drawing 2 . A fixed value is sufficient as the range of a punch Ruta limiter, and you may enable it to change it freely to change the range. And at step S2, in order that a computer 1 and the mode controller 23 may communicate with a predetermined period, a timer is set up. If these initialization actions are completed, control will move to the event waiting state in which step S3 carries out various generating, and control will move from step S3 to it corresponding to the generated event. The event to generate has the timer event (step S4) and panorama creation request event (step S5) which were set up previously.

[0087] The detail of the algorithm of a panorama creation request event is explained using the flow chart of drawing 16 . Generating of a panorama creation request event sets a panorama creation demand (FlagPa) at step S8 (True).

[0088] The detail of the algorithm of a timer event is explained using the flow chart of drawing 17 . The timer event of this example is an event generated in order to perform the communication link with a computer 1 and the mode controller 23 periodically. This timer event is generated at intervals of 50msec as an example. Generating of a timer event judges whether setting out of a communication link port is completed at step S11. setting out of a communication link port is completed (settled) -- ** -- if judged, control will move to step S12 and setting out of a communication link port will not be completed -- ** (sheep) -- if judged, control will move to step S18. Here, control moves only from the first time which setting out of a communication link port has not completed to step S18, and establishment processing of a communication link port is performed. Specifically in step S18, establishment of the RS-232C port on a computer 1 is performed.

[0089] In the timer event after it, transmitting processing of the commo data for transmitting processing of the data which have accumulated in transmission buffers, such as a check of received data, analysis processing, and an actuation

instruction of punch Ruta 28, or punch Ruta 28, and the condition acknowledge request of a zoom lens 16 is performed. With this algorithm, by step S12, control moves from step S11 to step S12, and when the existence of the data of a receive buffer is checked and received data exist, control moves to step S13, and when received data do not exist, control moves to step S14. At step S13, the received data which exist in a receive buffer are analyzed, and the positional information (p, t) of punch Ruta 28 required of the mode controller 23 and the positional information (z) of a zoom lens 16 are acquired. It is changed into the include-angle information on punch Ruta 28 (theta, phi), and the scale-factor information (gamma) on a zoom lens 16 according to the method of drawing 11 which these data mentioned above, and drawing 14 .

[0090] Next, the existence of the Request to Send of data is checked at step S14. When the Request to Send of data exists (FlagSo==True), control moves to step S19, and after transmitting processing of the data stored in the transmission buffer is made, a Request-to-Send flag (FlagSo) is reset at step S19 (False). As an example of the data which accumulated in this transmission buffer, there are data of an actuation instruction of punch Ruta 28 set up with the mouse 8 etc. And when there is no Request to Send (FlagSo==False), control moves to step S15. At step S15, it is judged [the internal counter (ReqCnt) of a Request to Send] for 0 whether it is no, when the internal counter of a Request to Send is 0

(ReqCnt=0), control moves to step S16, and when the internal counter of a Request to Send is not 0 (ReqCnt!=0), control moves to step S20.

[0091] At step S16, the location demand instruction of punch Ruta 28 and a zoom lens 16 is transmitted to the mode controller 23. And at step S17, the increment of the internal counter (ReqCnt) of a Request to Send is carried out.

[0092] At step S20, when it is judged whether a panorama creation demand exists and a panorama creation demand exists (FlagPa==True), control moves to step S21, and when a panorama creation demand does not exist (FlagPa==False), control moves to step S22. Panorama creation processing mentioned later is performed at step S21. And at step S22, the internal counter (ReqCnt) of a Request to Send is set to 0.

[0093] Next, the algorithm of the panorama creation processing mentioned above is explained using the flow chart of drawing 18 . Panorama creation is set up by the panorama creation request event (FlagPa=True). If this panorama creation request event occurs beforehand, as mentioned above, panorama creation processing (step S21) will be performed at the time of a timer event. In this flow chart, the procedure of panorama creation processing is performed according to the panorama counter (PanoCnt).

[0094] First, initiation of this processing performs processing which sets the field angle of image pick-up equipment as the maximum wide angle. That is, in step

S31, when it is judged whether a panorama counter (PanoCnt) is 1 and a panorama counter is judged to be 1 (PanoCnt ==1), control moves to step S43, and when it is judged that a panorama counter is not 1 (PanoCnt !=1), control moves to step S32. At step S43, while transmitting the actuation instruction which moves a zoom to a wide edge, a panorama counter is incremented. This is for performing a wide range panorama image by small image acquisition time.

[0095] At step S32, when it is judged whether a panorama counter is 2 and a panorama counter is judged to be 2 (PanoCnt ==2), control moves to step S44, and when it is judged that a panorama counter is not 2 (PanoCnt !=2), control moves to step S33. At step S44, while transmitting the actuation instruction which moves punch Ruta 28 to the position (POS (PanoCnt-2)) photoed first, a panorama counter is incremented. That is, processing which moves to the first location (location shown by 1 of drawing 5) which acquires the field angle of punch Ruta 28 shown by POS (PanoCnt-2) is performed.

[0096] Moreover, the capture of an image is performed, when it checks that image pick-up equipment had moved to the set-up zoom and a punch Ruta location when a panorama counter (PanoCnt) was after three and arrives at the specified location. At step S33, when the check of the positional information (z) of a zoom lens 16 is performed and the zoom location suits, control moves to step S34, and when the zoom location does not suit, this flow chart is ended.

Furthermore, at step S34, when the check of the positional information (p, t) of punch Ruta 28 is performed and the punch Ruta location suits (==POS (PanoCnt-3)), control moves to step S35, and when the punch Ruta location does not suit (!=POS (PanoCnt-3)), this flow chart is ended. And the image of a current punch Ruta location is acquired at step S35. The acquired image is memorized by memory as an image file of a bit map.

[0097] At step S36, the actuation instruction which moves punch Ruta 28 to the position (POS (PanoCnt-2)) photoed next is transmitted. At step S37, as mentioned above, data conversion of the acquired image is carried out to the virtual spherical surface, and connection processing of an image in which deletion of a duplication image and an unnecessary image is performed is performed. Moreover, when there is no throughput of a computer 1, at this step S37, compression is also performed to horizontal and a perpendicular direction. At step S38, the connected image is normalized and displayed by the LAT and LONG. And the increment of the panorama counter (PanoCnt) is carried out at step S39.

[0098] That is, deletion of the map processing to the virtual spherical surface of the image which performed processing which moves punch Ruta 28 to the image acquisition location of a degree, then carried out the capture previously, a horizontal, the compression processing to a perpendicular direction, a

duplication image, and an unnecessary image etc. is performed, and the progress situation of panorama image creation is displayed. It carries out until a panorama image completes the above actuation.

[0099] When it is judged whether the panorama image was completed thoroughly and it is judged that it completed, control moves to step S41, and at step S40, when it is judged that it is incomplete, it ends, and this flow chart is repeated until a panorama image completes above-mentioned control again. At step S41, since the panorama image was completed, a panorama creation demand (FlagPa) is reset (False). And the completed panorama image is saved at step S42.

[0100] If the image of 10 shown in drawing 5 which can gain the image of 1 shown in drawing 5 in this flow chart when a panorama counter (PanoCnt) is 3, can gain the image of 2 shown in drawing 5 when a panorama counter is 4, and is gained when a panorama counter is 12 is gained, all the images for generating a panorama image will be gained, and a panorama image will be completed.

[0101] In addition, to the target position where it is ordered here, the driving gear operated so that it might always advance from homotopic, and it has amended the gap of the connection image by the play (for example, backlash of a gear) of the device of the drive system which may be generated in the case of image connection.

[0102] A panorama image as shown in drawing 21 C from the image of ten sheets as shown in drawing 21 A according to 1 operation gestalt of this invention mentioned above can be obtained.

[0103] With 1 operation gestalt mentioned above, it is made as [perform / all control / using one computer]. To be shown in drawing 19 , other operation gestalten of this invention share a role between the computer for servers, and the computer for clients, and control a punch Ruta camera also by the gestalt which has a limit in channel capacity like a network circuit. The computer 1 to which the monitor 2 and the mouse 8 are connected controls actuation of the punch Ruta camera 3 installed in the remote place through the transmission line and the server 9. That is, an image pick-up equipment controller is constituted by the computer 1. As a transmission line, the existing various things, such as a communication line (wireless, cable) and a network, are usable. A computer 1 has the relation of a client to a server 9, and connection of two or more computers 1 is possible to a server 9.

[0104] The punch Ruta camera 3 and a server 9 are installed in the actual scene in an environment as shown in 4. The screen (a photography screen is called hereafter) photoed with the punch Ruta camera 3 installed in the actual scene 4 of this environment is shown in 5. This photography screen 5 is a screen currently photoed actually, if a zoom lens is operated to a looking-far side, a field

angle will become small, and a field angle will become large if it is operated to a wide side.

[0105] The image of the photography screen 5 incorporated with the punch Ruta camera 3 is changed into image data by going via a server 9. This image data is supplied to a computer 1 through a transmission line. The image data supplied to the computer 1 are displayed on a monitor 2. In a monitor 2, the supplied photography screen 5 is displayed on actuation field 6A on the screen of a monitor 2.

[0106] Moreover, in the monitor 2, it has panorama actuation field 6B and panorama generation carbon button 6E. Creation directions of a panorama image are sent to a server 9 by panorama generation carbon button 6E, in a server 9, while driving punch Ruta and a zoom to a position and acquiring an image in each location, an image is connected to the virtual spherical surface which made the movable shaft of punch Ruta the zero for the acquired image of two or more sheets, and the flat-surface image which normalized to the LAT of the virtual spherical surface and the direction of LONG is created. The created panorama image is displayed on panorama actuation field 6B of a monitor 2 by computer 1 through a transmission line from a server 9.

[0107] Moreover, the cursor 7 of an arrow-head form is drawn by panorama actuation field 6B like 1 operation gestalt mentioned above in the location of a

mouse 8. The punch Ruta camera 3 is operated by directing one point or field 6C of the arbitration in an image or a panorama image with a mouse 8. Furthermore, as a dotted line shows, punch Ruta limiter display 6D is displayed on panorama actuation field 6B. Punch Ruta liter display 6D shows the limitation of the movable range of the punch Ruta camera 3.

[0108] And by operating a mouse 8, cursor can be moved and can direct one point of the arbitration of panorama actuation field 6B, or one point of the arbitration generated from field 6C of arbitration. Punch Ruta is made to drive through a server 9 and a transmission line, and the image pick-up screen 5 moves so that one point of the directed arbitration may become in the center of actuation field 6A. That is, it is displayed that the selected photographic subject becomes in the center of panorama actuation field 6B through a server 9 and a transmission line.

[0109] Drawing 20 is the block diagram of all the systems of other operation gestalten of implementation of this invention. However, since the configuration of the camera section 11 and the punch Ruta section 12 and the function are the same as that of 1 operation gestalt (drawing 3) mentioned above, the detailed configuration is omitted in drawing 20 . A server 9 consists of a control section 131, the video capture section 129 which consists of a video capture board, and the storage section 30. It connects in the transmission line 132 and the network,

and a computer 1 consists of control-section 31 grades like 1 operation gestalt shown in drawing 3 . In addition, also about the detailed algorithm in each computer, since said 1 operation gestalt and content overlap, the explanation is omitted.

[0110] Like 1 operation gestalt, signal processing of the image pick-up light which reaches from a photographic subject is carried out in the camera section 11, it is changed into each signals, such as brightness (Y), a color (C), and a video signal, and is supplied to the TV monitor 13 and the video capture section 129 of a server 9 as a video signal. Moreover, as 1 operation gestalt, a punch Ruta camera has the mode controller 23, the camera controller 24, and the punch Ruta controller 25, and is controlling the camera section 11 and the punch Ruta section 28. The mode controller 23 controls the whole system like 1 operation gestalt according to the internal state of the camera section 11 and the punch Ruta section 12, and the instruction from the outside.

[0111] The mode controller 23 is connected with a server 9 according to a channel (specifically, RS232C is used), and the received instruction is distributed to the punch Ruta controller 25 and the camera controller 24 so that the zoom lens 16 of punch Ruta 28 and the lens block section 15 may be driven to the instruction sent by server 9 course from the instruction directly sent from a server 9, or a computer 1. Moreover, since the mode controller 23 sends out the

internal state of a punch Ruta camera outside via a server 9, it always acquires information from the punch Ruta controller 25 and the camera controller 24.

[0112] A server 9 acquires periodically the internal states (for example, punch Ruta, current positional information of a zoom lens, etc.) of a punch Ruta camera from the mode controller 23 of the punch Ruta section 12. Moreover, since the image of the camera section 11 is sent out to a transmission line 132, the video capture section 129 is used and the image information inputted from the camera section 11 has been changed into the digital image data (specifically the still picture of a JPEG format or the still picture of a bit map format) which is easy to send out to a transmission line 132 in the quality of arbitration. Moreover, storage of the digital image of an isomorphism type can be carried out on the storage section 130 (for example, hard disk).

[0113] If a connection request is made from a computer 1 to a server 9, a server 9 sends out the GUI (graphical interface) panel information for displaying on the monitor 2 connected to the computer 1. As panel information, there is a program of operation in the computer 1 when mouse actuation is carried out on arrangement of a panel and a panel etc., and, specifically, the program of HTML and JAVA is used. Moreover, the condition of the image data which the punch Ruta camera picturized periodically, and a punch Ruta camera etc. is sent out to a computer 1 through a transmission line 132.

[0114] With other operation gestalten, the Internet is used for a transmission line 132 and picking is made in the transmission-line 132 top using HTTP pro TORUKO. Moreover, the GUI panel information sent from a server 9, image information, a punch Ruta camera condition, etc. are expressed to a monitor 2 as a computer 1 using the browser for the Internet. Actuation field 6A and panorama actuation field 6B, the manual operation button of a zoom, the cursor of a pointing device 14 (mouse 8), etc. are displayed on the GUI panel displayed on the screen of a monitor 2. And a decoding indication of the image data sent from a server is given, and an image is rewritten by actuation field 6A with renewal of image data. Moreover, the panorama image data sent from a server 9 is decoded, a panorama image is displayed on panorama actuation field 6B, and the operating range of a punch Ruta camera and the location of current punch Ruta, the field angle of a zoom, etc. are further expressed to it as the same technique as 1 operation gestalt. And a program of operation when the GUI panel by which the computer 1 has been sent from the server 9 is operated is executed.

[0115] The above-mentioned program of other operation gestalten of operation generates an actuation instruction to a punch Ruta camera, and the instruction of operation on a server by click actuation of a mouse. When a mouse is clicked, on actuation field 6A like 1 operation gestalt Field angle information, current

punch Ruta positional information, and the positional information of the mouse when being clicked to origin An instruction (absolutely a location actuation instruction or a relative-position actuation instruction) is sent to a server 9 so that the location by which the mouse click was carried out on the image displayed on actuation field 6A may come to the core of actuation field 6A (graphic display) and punch Ruta may drive.

[0116] If a server 9 acquires this instruction, an instruction will be relayed, it will send to a punch Ruta camera, and punch Ruta will drive in a desired location. Thus, in order to set up the actuation target of punch Ruta on an image, it becomes possible to operate punch Ruta easily, without being conscious of an actuation instruction in a network, the delay of an image, etc.

[0117] By computer 1, it becomes possible to display the sent panorama image to put on panorama actuation field 6B of a monitor 2, and to display the environment where the current punch Ruta camera is set up, at a glance. Moreover, as previous explanation also described, since the actuation range of the positional information of punch Ruta, a zoom lens field angle, and punch Ruta is displayed, it becomes possible on a panorama image to check the condition of current punch Ruta easily at panorama actuation field 6B. That is, if the instruction whose computer 1 or server 9 drives punch Ruta and a zoom is generated, the situation of the punch Ruta camera according to it can check on a

panorama image.

[0118] Moreover, on panorama actuation field 6B, when a mouse is clicked, the location where the mouse click of [on a panorama image] was carried out sends an instruction (absolutely location actuation instruction) to a server 9 like 1 operation gestalt based on the positional information of the mouse when being clicked, so that it may come to the core of actuation field 6A (image) and may drive. If a server 9 acquires this instruction, an instruction will be relayed, it will send to a punch Ruta camera, and punch Ruta will drive in a desired location. Thus, in order to set up the actuation target of punch Ruta on a panorama image, it becomes possible to operate punch Ruta easily, without being conscious of an actuation instruction in a network, the delay of an image, etc.

[0119] After all the images are connected, you may make it express it to panorama actuation field 6B as the operation gestalt of this invention, although a panorama image is connected within a computer 1 whenever an image is supplied to a computer 1 from the punch Ruta camera 3, and it shows the image to panorama actuation field 6B whenever it is connected.

[0120] Although actuation field 6A and panorama actuation field 6B are expressed as the operation gestalt of this invention on the screen of the monitor 2 connected to the computer 1, actuation field 6A and/or panorama actuation field 6B may be displayed on another display which is different in a monitor 2.

[0121] With the operation gestalt of this invention, it is good also as a maximum range where the punch Ruta camera 3 can carry out movable [of the range which can be photoed with the punch Ruta camera 3], and the range which can be photoed by the limiter may be restricted. Moreover, you may have the function in which the limiter restricts photographic coverage in the punch Ruta camera 3, and may have it in a computer 1.

[0122] Although one point of the arbitration generated from the field of arbitration was set as the core of that field with the operation gestalt of this invention, it is good also considering the circumcenter, the inner center, center of gravity, or orthocenter of the field of not only it but arbitration as one point of arbitration.

[0123] Although made as [create / by computer 1 / a panorama image] with other operation gestalten of this invention, a panorama image is created by the server 9, the data of that panorama image are transmitted to a network circuit with little circuit capacity at a computer 1, and you may make it display on panorama actuation field 6B of a monitor 2.

[0124] Although it considered as one computer 1 to the server 9 and the punch Ruta camera 3 which were installed in the remote place in order to give explanation easy, a server 9 and the punch Ruta camera 3 are arranged all over the world, for example, you may make it control one punch Ruta camera 3 by other operation gestalten of this invention from two or more computers through

the Internet.

[0125]

[Effect of the Invention] If it depends on this invention, since the technique of mapping and connecting the picturized image on the virtual spherical surface is taken, it becomes possible to offer the image which does not have distortion in the connection section. a high which is obtained only using the device of high resolution, and a graphics format even if it connects the image of the device using the device of low cost, and a graphics format by this -- a quality (high definition, high quality) -- an image can be obtained. Moreover, effectiveness is expectable with the application which used it for the equipment (for example, camera with built-in punch Ruta) which can change the image pick-up direction of image pick-up equipment since the panorama image which generally becomes possible using the lens or fish-eye lens of an expensive super-wide angle system was created easily.

[0126] Moreover, since a location to drive on a panorama image and a photographic subject to project can be specified by displaying a zoom field angle, a punch Ruta location, etc. on a panorama image, for example while becoming possible to grasp the situation of image pick-up equipment easily if it depends on this invention, it becomes possible although the target image is acquired easily. Better operability and visibility are realizable using a panorama image for such

applications especially for control applications, such as a monitor in the video camera in the remote place using a circuit, observation, advice, and introduction.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is approximate line drawing showing the rough configuration of the system of 1 operation gestalt of this invention.

[Drawing 2] It is approximate line drawing for explaining the screen in 1 operation gestalt of this invention.

[Drawing 3] It is the block diagram showing the system configuration of 1 operation gestalt of this invention.

[Drawing 4] It is approximate line drawing for explaining generation of the panorama image in 1 operation gestalt of this invention.

[Drawing 5] It is a schematic diagram for explaining generation of the panorama image in 1 operation gestalt of this invention.

[Drawing 6] It is a schematic diagram for explaining generation of the panorama image in 1 operation gestalt of this invention.

[Drawing 7] It is approximate line drawing which had in the explanation which

generates the include-angle information on a punch Ruta camera, and was from the position coordinate on the panorama actuation field in 1 operation gestalt of this invention.

[Drawing 8] It is approximate line drawing for explaining the flat-surface spherical-surface conversion in 1 operation gestalt of this invention.

[Drawing 9] It is approximate line drawing for explaining the coordinate transformation in the actuation field in 1 operation gestalt of this invention.

[Drawing 10] It is approximate line drawing for explaining the coordinate transformation in the panorama actuation field in 1 operation gestalt of this invention.

[Drawing 11] It is approximate line drawing for explaining the internal positional information and the include-angle information on a punch Ruta camera in 1 operation gestalt of this invention.

[Drawing 12] It is approximate line drawing for explaining the include-angle coordinate of a punch Ruta camera and the position coordinate of a panorama actuation field in 1 operation gestalt of this invention.

[Drawing 13] It is approximate line drawing for explaining the field angle of the punch Ruta camera in 1 operation gestalt of this invention, and the frame in a panorama actuation field.

[Drawing 14] It is approximate line drawing for explaining conversion of the zoom

data in 1 operation gestalt of this invention and scale-factor data.

[Drawing 15] It is the flow chart which shows an example of processing of the whole 1 operation gestalt of this invention.

[Drawing 16] It is the flow chart which shows an example of processing of the panorama creation request event in 1 operation gestalt of this invention.

[Drawing 17] It is the flow chart which shows an example of processing of the timer event in 1 operation gestalt of this invention.

[Drawing 18] It is the flow chart which shows an example of the panorama creation processing in 1 operation gestalt of this invention.

[Drawing 19] It is approximate line drawing showing the rough configuration of the system of other operation gestalten of this invention.

[Drawing 20] It is the block diagram showing the system configuration of other operation gestalten of this invention.

[Drawing 21] It is approximate line drawing for explaining creation of a panorama image.

[Description of Notations]

1 [... Panorama actuation field,] ... A computer, 2 ... A monitor, 6A ... An actuation field, 6B 7 [... Punch Ruta section,] ... Cursor, 9 ... A server, 11 ... The camera section, 12 13 ... TV monitor, 14 ... A pointing device, 15 ... Lens block section, 16 ... A zoom lens, 17 ... The zoom section, 18, 26, 27 ... Motor, 19 ... A

solid state image pickup device, 20 ... Signal separation / automatic-gain-control circuit, 21 [... A camera controller, 25 / ... A punch Ruta controller, 28 / ... Punch Ruta, 29 / ... Video capture, 30 / ... The storage section, 31 / ... Control section] ... An A/D converter, 22 ... A digital disposal circuit, 23 ... A mode controller, 24